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(19)

(54) IMPROVEMENTS IN FLUID FLOW CONTROL VALVES

(71) We, KITAMURA VALVE MANUFACTURING CO. LIMITED, a joint-stock company of Japan, 12-5, Nishiogu, 7-chome, Arakawa-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to fluid flow control valves.

It is well known in the art that static electricity is generated when a non-conductive fluid is passed through a metal valve or when a metallic valve element is operated and moves in frictional contact with electrically insulative valve seats in the valve housing of a ball valve or plug valve. If a valve is constructed such that the stem for operating the valve element is electrically insulated from the valve housing or if the valve element is electrically insulated from the valve stem during the operation thereof for some reason, the valve element is charged with the static electricity produced in the above-mentioned manner. Static electricity may be a source of danger. Discharge of static electricity often takes place between the valve element and the valve housing due to a high potential difference. If such a valve is used to control inflammable fluid, the discharge is liable to cause combustion and explosion of the fluid.

The present invention has as its object to provide a fluid flow control valve having an electrical path between the valve element and ground so as to prevent the valve element from building up a dangerous charge of static electricity.

According to this invention we provide a fluid flow control valve comprising a metal valve housing, a metal valve element rotatably mounted in the valve housing about a vertical axis and electrically insulative valve seats interposed between the valve housing and the valve element, wherein the bottom of said metal valve element has a relatively shallow recess and is rotatably borne by an electrically conductive support member located between said valve element and the bottom of said valve housing at a position coaxial with the axis of rotation of said shaft, the uppermost portion of said support being received in said recess, and wherein a graphite sheet is interposed between the contact faces of said support member and said valve housing.

Specific embodiments of a fluid flow control valve according to this invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a plan view of a ball valve;

Figure 2 is an elevational sectional view of the ball valve of Figure 1 taken along the line II—II, illustrating the novel construction according to the invention, and

Figure 3 is a fragmentary sectional view illustrating another embodiment of the invention.

Referring first to Figures 1 and 2, the reference numeral 1 is generally applied to a valve housing made of metal and having a spherical valve chamber 2 and a pair of axially aligned fluid passages 3 and 4. The valve housing consists of housing sections 5 and 6 having flanges 7 and 8, respectively, which mate together and are fastened to each other by means of studs 9 and nuts 10 to form unitary valve housing 1.

The reference numeral 11 is applied to a spheroidal valve element made of metal. The diameter of the valve element 11 is made slightly smaller than that of the spherical valve chamber 2. The valve element 11 has a cylindrical passageway 12 extending therethrough and being adapted to register with the fluid passages 3 and 4. The valve element 11 has opposite open sides 13 extending vertically in conformity to the corresponding openings of the fluid passages 3 and 4; and at the portions adjacent to the open sides 13 the valve element 11 is borne by annular valve seats 14 which are made of wear-resistant synthetic resin and located in respective annular grooves or recesses 15 formed in the wall of the valve chamber 2 adjacent to

the openings of the fluid passages 3 and 4, respectively.

A vertical valve stem 16 has at its lower end a key 17 which engages a similar shaped slot in the central top of the valve element 11. The stem 16 is rotatably disposed in a neck 18 and vertically extends through a packing 19, washer 20 and sleeve 21 individually made of synthetic resin.

The valve element 11 is formed at the bottom centre thereof with a conical recess 22 coaxial with the line of extension of the axis of stem 16. In alignment with the line of extension of the axis of stem 16, a conical recess 23 is formed in the valve chamber 2 on the bottom wall of valve housing 1. Disposed in and engaged with both recesses 22 and 23 is a metal ball 24 for rotatably supporting the valve element 11 and for providing an electrical path between the metal valve element 11 and the metal valve housing 1.

The recess 23 in the valve housing 1 may be formed on the top end of a plug 25 which is screwed into a threaded hole provided through the central bottom wall of the valve housing 1. A thin graphite sheet 26 is interplaced between the ball 24 and the bottom of the recess 23 so as to reduce wear and improve electric conductivity. Numeral 27 is applied to a lever for operating the valve stem 16; numeral 28 is applied to a cover for a gland 29.

It will be appreciated that the valve element 11 in the valve according to this invention is short-circuited to the valve housing through the metal ball 24, although the valve element and the valve stem 16 are electrically insulated from the valve housing by means of the insulative valve seats 14, sleeve 21, etc. Thus, in the event that static electricity is produced in the valve element 11 due to the flow of fluid being controlled or due to the frictional rotation of the valve element, it is conducted to the metal valve housing 1 through the metal ball 24 and thence safely to the ground. Thus the hazardous discharge will never take place between the valve element and the valve housing.

According to the construction of the valve of the invention, a part of the weight of the valve element 11 is borne by the ball 24 so that the valve seats 14 are prevented from eccentric loading and wearing and that the torque necessary for operation of the valve element 11 may be reduced. Further, even in the case that the valve seats 14 have been extremely worn or burnt due to a fire or the like accident, the valve of the invention will still function to control the flow of fluid because the valve element 11 will be retained in its functional position in the valve chamber 2.

In the illustrated example, the recess 23 is formed not directly on the valve housing 1 but on the plug 25 screwed into the bottom wall of the valve housing in order to facilitate the assembling of the valve and to properly adjust the pressure of contact of the ball 24 against the recesses 22 and 23.

The valve construction according to the embodiment illustrated in Figure 3 is substantially the same as that of the first embodiment except that the recesses on the valve element 11 and the valve housing 1 are made cylindrical recesses 22*a* and 23*a*, respectively, the axes of which are coaxial with the line of extension of the axis of stem 16. The provision of an electrical path between the valve element and the valve housing and the rotational support of the valve element are performed by a compresssion spring 24*a* made of metal. More specifically, the recess 22*a* is formed in the bottom of the spheriodal valve element 11 in alignment with the axis of rotation of the valve element and receives an end of the spring 24*a* which bears against a thin graphite sheet 30 trapped in the bottom of the recess 22*a*. The recess 23*a* is formed in the top of the plug 25 which is to be screwed into the bottom wall of the valve housing. The other end of spring 24*a* bears against a thin graphite sheet 26 trapped in the bottom of the cylindrical recess 23*a* in the plug 25. The sheets 26 and 30 serve to minimize the wear of spring 24*a* and to improve the electric conductivity in the path between the valve element and the valve housing.

Obviously the valve according to the construction of Figure 3 has the same advantages and operates in a similar manner to that described in the first embodiment.

WHAT WE CLAIM IS:—

1. A fluid flow control valve comprising a metal valve housing, a metal valve element rotatably mounted in the valve housing about a vertical axis and electrically insulative valve seats interposed between the valve housing and the valve element, wherein the bottom of said metal valve element has a relatively shallow recess and is rotatably borne by an electrically conductive support member located between said valve element and the bottom of said valve housing at a position coaxial with the axis of rotation of said shaft, the uppermost portion of said support being received in said recess, and wherein a graphite sheet is interposed between the contact faces of said support member and said valve housing.

2. A valve as claimed in claim 1, wherein

said support member is a ball made of metal.

3. A valve as claimed in claim 1 wherein said support member is a compression spring made of metal.

4. A valve as claimed in claim 1, wherein a graphite sheet is interposed between the contact faces of said support member and said valve element.

5. A valve as claimed in any one of the preceding claims wherein said valve housing is formed in the central portion of the bottom thereof with a recess for receiving the lower end of said support member.

6. A valve as claimed in claim 5, wherein the recess in the valve housing is formed in the top of an adjustable plug screwed into the bottom wall of said valve housing, whereby the pressure exerted against said valve element by said support member can be adjusted.

7. A fluid flow control valve substantially as described herein with reference to and as illustrated in the accompanying drawings.

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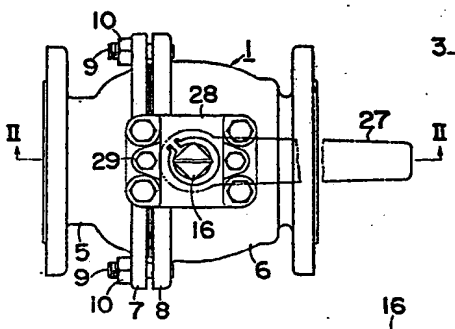

FIG. 1

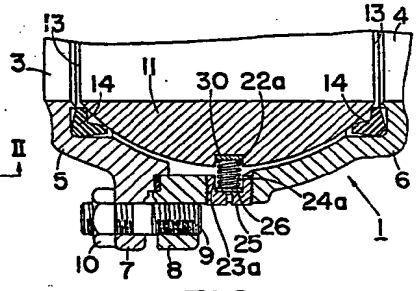

FIG. 3

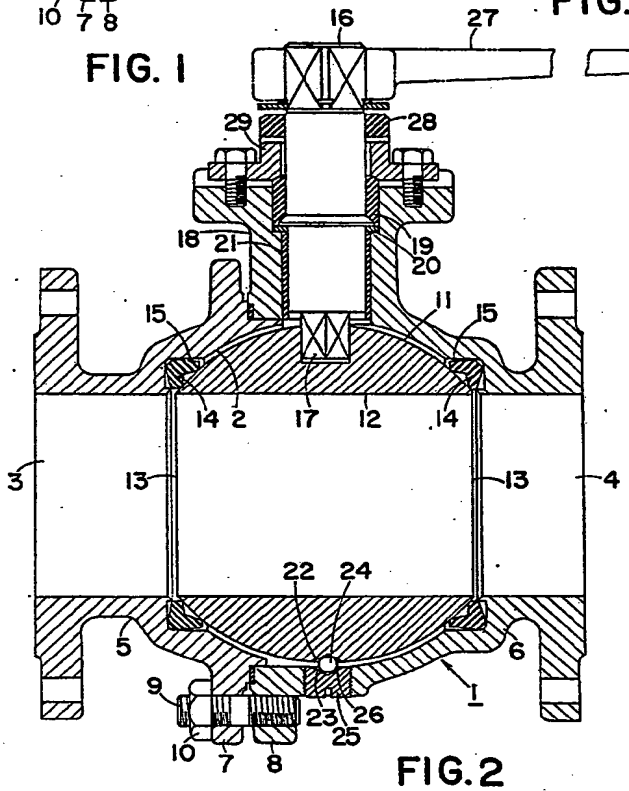

FIG. 2